

NWp

622.1841

B812

PRACTICAL PROSPECTING FOR GOLD AND SILVER,  
AND THE PRELIMINARY DEVELOPMENT OF  
METALLIFEROUS VEINS.

BY JAMES BRADY.

Surveyors in the practice of their profession have many opportunities of examining the rock formation, and ascertaining to some extent the mineral resources of various parts of the country, and, although many members of the Profession and of this Association are quite as well posted as I am on the above subjects, others may not have given them much attention, and will not object to a few hints that may assist them in determining when they are in a country that may be expected to produce gold, silver, or other ores; how to search for the same in an intelligent manner; and how veins may be opened up in a preliminary way, so as to ascertain, as cheaply and quickly as possible, the character, value per ton, and probable production of ore, thus determining the nature of reduction works required, and being enabled to estimate the cost of mining and reduction plant necessary to work the mine to its full capacity, and of the returns and profits that may be anticipated.

It is said that most of the great mines of the world were found by chance, and not by regular prospectors. This is probably true as regards lodes and veins; but it must be remembered that until within very recent years the average miner or prospector had little or no knowledge of the rock formations in which gold, silver and other metalliferous veins were likely to be found, and simply roamed over the mountains in a haphazard way, and was as likely to look for gold quartz in cretaceous limestone as in metamorphic slates, or to follow the wrong formation longitudinally as to cross it and get into a better one.

One instance, however, may be mentioned, where intelligent observation and persevering search led to the discovery of immense gold fields and the settling up of a great continent, namely, the discovery of gold in Australia by Hargraves in 1851.

Nothing will build up a new country so rapidly as the discovery of gold and silver mines. Agricultural and manufacturing enterprises are of slow growth, no matter how fertile the soil or how excellent the facilities for successful operation, unless they are given an impetus by something such as the discovery of gold or silver, which will cause an immediate influx of population.

N. P. Wolfe  
\$6.00  
Jan. 11/73

When such a rush occurs, as is generally the case on the first opening up of a new mining country, the work of exploring and development goes on rapidly, and all the resources of the country are developed in a proportionally rapid manner. Lumbering, farming, and stock raising enterprises spring at once into existence, as the mines furnish a ready market and good prices for their products.

The old pioneer prospector is rapidly disappearing, and organized prospecting and exploring parties, under the direction of competent mining engineers and experts, are taking his place; and this manner of acquiring mineral properties will be largely adopted in the future, as being the cheapest and in every way the most satisfactory manner of gaining possession of valuable mining rights.

The head of such a party, starting out to prospect any particular range of country, would first acquaint himself with all the geological and other information to be had from the reports of the Geological Survey, and other parties who had visited the region of his intended explorations. Failing such sources of information he would take such reports and evidence, as he could find, relating to the mineral resources, etc., of other districts on the same geological belt or mineral zone, and thus get some idea of where to look for the particular class of ore or mineral desired.

The following extracts from an article, on "Mineral Zones and Mountains" from the "Mining and Scientific Press," will help to explain this point.

"One of the plates accompanying King's Exploration of the 40th Parallel is a section of the Warren Map of the U. S. Engineer Department. The section given includes the main central region of the Great Basin, with a part of the coast system of California, and the outlying chains of the Rocky Mountains. A brief study of this map will teach the *one great and prominent law of arrangement of Cordillera Mountain chains*, namely, *that they trend from North to South, or from Northwest to Southeast.*

"In strict subordination to this longitudinal direction of ranges, says King, are grouped all the structural features of local geology. The average strike of the great areas of upturned strata is generally with the meridian. All the larger outbursts of granitic rocks conform to it as well, since their rents are most commonly the axial lines of actual folds; and lastly, when the tertiary uplift occurred, its ranges bordered the older mountains in parallelism, and the volumes of lava accompanying it found exit through longitudinal rents, and either built themselves up along the

P. Wolfe  
00  
n. 11/73

### Prospecting for Gold and Silver.

3

"ancient line of structure, or through new fissures piled up chains  
"of volcanoes conforming in trend with the general north and  
"south plan.

"*Over these mountains are found localities of the precious*  
"metals, and it is not surprising to observe that, following its  
"leading structural idea, *they appear to arrange themselves in*  
"parallel longitudinal zones.

1. "The Pacific coast ranges on the West carry quicksilver, tin,  
"and chromic iron.

2. "The next belt is that of the Sierra Nevada and Oregon  
"Cascades, which upon their west slope bear two zones; a foot-hill  
"chain of copper mines, and a middle line of gold deposits. These  
"gold veins and the resultant placer mines extend far into British  
"Columbia and Alaska.

3. "Lying to the east of this zone, along the east base of the  
"Sierras, and stretching southward into Mexico, is a chain of  
"silver mines containing comparatively little base metal, and fre-  
"quently included in Volcanic rocks.

4. "Through Middle Mexico, Arizona, Middle Nevada and  
"Central Idaho, is another line of silver mines, mineralized with  
"complicated association of the base metals, and more occurring  
"in older rocks.

5. "Through New Mexico, Utah, and Western Montana lies  
"another zone of argentiferous galena lodes.

6. "To the east again the New Mexico, Wyoming and Montana  
"gold belt is an extremely well defined and continuous chain of  
"deposits."

From this it can be seen how any information relating to the  
geological structure, and rock formations of a district, or the  
character of its ores, will assist in determining what may be  
expected at other points, in similar respective positions, on the  
same range. As an illustration of this, I may mention the fact that  
on the Selkirk Range, in Kootenay District, B.C., large and valuable  
lodes of silver-bearing lead and copper, associated with other base  
metals, have lately been discovered. The ores of this district  
correspond in character with those of Idaho and Western Montana,  
immediately south and on the same range, and with those of  
mineral zones 4 and 5.

It being a fact that nearly all the valuable gold-bearing veins of  
the world have been found in metamorphic slates and schists of  
different ages, from the Silurian in Australia to the Jurassic in  
California; it is more resonable, and one is more likely to prove

successful, in searching for gold, to confine one's explorations to metamorphic rocks. In like manner, all the great gold placers, being chiefly composed of sand, clay, gravel and boulders derived from these and allied rocks, it seems reasonable to prospect for gold placers on the lower slopes and benches of mountains and hills composed of such rocks (particularly where traversed by many quartz veins), and on the rivers and streams draining a country of the above character.

Gold-bearing lodes may be looked for in quartz veins traversing, and interstratified with the softer metamorphic crystalline rocks such as argillaceous, chloritic, talcose and hydromica slates and schists; also, to a much less extent in granite, gneiss and the harder metamorphic rocks.

The minerals or ores commonly associated with gold, in quartz veins, are iron, copper, lead and zinc sulphurets, and sometimes tellurium; the presence of one or more of these being considered a good indication in a gold country, and their entire absence as unfavorable to the permanency and regular yield of the lode—even though free gold may be visible in the quartz. The most permanently productive gold quartz mines have been those in which free gold was seldom or never seen, and the above sulphurets were more or less represented.

The quartz is frequently rusty or cellular, and discolored brown, yellow, reddish, blue, etc., by the decomposition of the base ores accompanying the gold.

The most certain and reliable way of finding out if a quartz vein carries gold, in paying quantities, is to pound up pieces from different parts of the vein and pan them out. If the quartz is pounded very fine, and then carefully washed down in a pan or horn, fine particles of gold will be found, and can be seen with the naked eye, if there is sufficient in the quartz to pay for working; and it is not worth while spending much time over a vein (as a gold vein), unless colors can be found in that way. Of course gold is found in paying quantities associated with ores of silver and other metals, as in the Comstock Lode, where its presence cannot be ascertained by simply panning out; but this really comes under the head of silver ore, and will have to be assayed in a similar manner.

Veins and streaks of solid arsenical and other pyrites often carry gold, in what would appear to be paying quantities; but such mines have seldom been worked successfully.

Silver and its ores are so intimately connected with many of the

ores of lead, copper, antimony, zinc, etc., that in indicating the rocks in which we may expect to find silver-bearing veins, we necessarily include the others.

Native silver, Ruby silver, and silver ores proper, and such as are mixed with base metal ores to only a limited extent, are found most frequently in Syenite, Trachyte, Andesite, Porphyry,—Gneiss and allied metamorphic rocks,—and in shaly sandstone, conglomerates, etc., in the vicinity of eruptive rocks, and generally in a quartz gangue. Argentiferous galena, and carbonate of lead carrying silver, argentiferous grey copper ore, etc., in argillaceous shale and schists, crystalline limestone, etc., and porphyry. And low grade argentiferous galena and carbonates in carboniferous and other limestones.

The vein matter, or gangue, may be quartz or calc-spar, or both, and may be mixed with heavy-spar, flour-spar or pearl-spar; and in some of the largest and most productive lodes the vein matter is chiefly yellow and brownish clay, with boulders of iron maganese rock, and horses of the country rock, and in this character of gangue the largest chimneys of galena and carbonates, carrying silver, have been found.

The character and value of silver ores cannot be accurately determined, except by regular assay. They are mixed with so many other ores and minerals, that in many cases they cannot be distinguished from the ordinary ores of the base metals. After long experience a man may be able to form a fair estimate of the ores of the particular district in which he has been working; but take him into a new district where the combinations are different, and his opinion as to the value of an ore, from simple inspection, is quite worthless.

A collection of small specimens of different metallic ores, which can be obtained in New York, and readily carried along, will be of some assistance; and with a blow-pipe outfit, tests which will determine at least the presence or absence of silver, and many of the other metals, can be made. These with "Danas' Manual of Mineralogy," an elementary treatise on geology, and a book of instructions for the use of the blow-pipe—a gold pan or horn, and a bottle of Nitric Acid—will enable one to get a fair idea of any ore, rock, or mineral we may come across.

A pick and shovel, hand-crushing machine, or pestel and mortar, and one or two rock hammers and small prospecting poll picks should be carried along; and on regular prospecting expeditions, where such things can be packed or carried, a small bellows and

anvil, drills, striking hammers, powder, fuse, caps, etc., should form part of the outfit.

In prospecting a given belt of country, it is best to cross it as often as possible, and where the rock formation is most exposed; following up the beds of the streams, where practicable, and making lateral excursions at convenient points, and where the formation seems favorable.

At, or near, a change of formation, say from slate to granite or limestone; and near porphyritic or other igneous rocks, in stratified and metamorphic beds, large and productive lodes may be looked for.

Large veins are generally split up, or divided into several branches, in the valleys and crossings of streams; but the large and solid outcrops can generally be found on the high ridges on either side, by taking the general direction of the veins at the crossing, and it is usually on these ridges or hills that the largest and most valuable deposits of ore are found.

#### *Preliminary Development:*

The first thing to be done in opening up a lode is to ascertain the extent of the ore-body on the surface, so as to determine the best place for a shaft or tunnel. This can be done by sinking to bed rock at several places along the general line of the lode, where it is not already exposed, and making cross-cuts at these points. If the mine is to be opened up by means of a shaft, it may be located about the centre of this ore-body, and should follow the vein down. The dip of a vein is so liable to change near the surface, that a perpendicular working-shaft cannot be properly located until prospecting works have been carried to a depth of at least 200 or 300 feet. Drifts or levels should be run about every 60 feet, and, where the vein is wider than the drift, cross-cuts should be made at about the same distances apart. The extent to which this work should be carried, and the size of shaft, etc., must be determined by the nature of the vein and its ore, the developments made in sinking and drifting, and the amount of money the manager has at his command for this purpose. A shaft from 200 to 300 feet deep, and drifts as above, say 120 feet on each side of the shaft, with cross-cuts about every 60 feet, will generally be considered sufficient to decide the probable value of the property, and the cost of mining and reduction works for permanent operation.

The ore taken out of the shafts and drifts will help to pay for

the work, and the mine will be in a condition to put on men enough to stope out ore while reduction works are building, to keep them running while the permanent working shaft is being put down.

If the vein crops out on a side hill, or bluff, so that a tunnel can be run *along the vein*, at a sufficient depth from the outcrop on top, much time and money can be saved, and both hoisting and pumping works dispensed with. But if the strike of the vein is such that the tunnel must be run any distance *through country rock*, before encountering the vein, it must be prospected and proved to a sufficient depth, before a tunnel can be attempted without great risk of miscalculation and disappointment.

In lodes that are not too wet, rock and water can be hoisted for the first 100 feet by windlap, and from 200 to 300 feet by a whim; but where much water is encountered an engine will be required.

The following points in relation to Mining Claims should be carefully noted :—

1. Location or position on the Map.
2. How to reach it, and condition of roads, trails, &c.
3. Course, or strike, width and dip of vein or lode.
4. Class of ore or mineral, as nearly as can be ascertained.
5. Quality “ “ “ and samples, if possible.
6. Length and width of ore-body exposed.
7. Gangue or matrix of vein.
8. Character of walls.
9. Country rock.
10. Water-power, if any, fall, No. of inches, &c.
11. Quality and cost of wood, timber and lumber.
12. Cost of labor and board.
13. Price of provisions, grain, hay, &c.
14. Rate of freight from nearest railway station, steamboat landing, or town.
15. Distances from do.
16. How lode is situated for development by tunnel or shaft.
17. Distance and freight to nearest smelter or reduction works; rates paid for ore, or charge for reduction.
18. Remarks on climate, labor, supplies, grass, &c.
19. Sketch of claim and surroundings.

In closing this paper I will quote the following from a Report to the Legislative Council of Victoria, Australia, March, 1854 :—

“ The discovery of the Victoria gold fields has converted a remote



"dependency into a country of world-wide fame ; it has attracted a  
"population, extraordinary in number, with unprecedented rapidity ;  
"it has enhanced the value of property to an enormous extent ;  
"it has made this one of the richest countries in the world ; and in  
"less than three years it has done for this colony the work of an  
"age, and made its impulses felt in the most distant parts of the  
"world."

Knowing the immense results that have followed the opening up of mines in Australia, California, Nevada, Montana, &c., one would suppose that our government (both Provincial and Dominion) would offer every inducement to prospectors and miners to prosecute their work of exploration and development, instead of hampering them with unnecessary and harassing rules and regulations. The mining laws of all the Provinces and the Dominion should be assimilated, and many alterations made ; and mining machinery, which cannot be or is not manufactured in Canada, should be admitted free of duty, at least until such time as we can manufacture it ourselves.

VICTORIA, B.C., Feb. 11th, 1889.